TURCK

Industrial
Automation

BL20 –
USER MANUAL

ECO-GATEWAY
FOR
CANopen

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Subject to alterations without notice

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

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1.1 Documentation Concept

This manual contains all information about the BL20-CANopen gateway of the product series BL20-ECO (BL20-E-GW-CO).

The following chapters contain a short BL20 system description, a description of the field bus system CANopen, exact information about function and structure of the CANopen-gateway as well as all bus-specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules for BL20 as well as all further fieldbus-independent chapters like mounting, labelling etc. are described in a separate manual.

- BL20 I/O-modules (TURCK-Documentation-No.: English D300717)

Furthermore, the manual mentioned above contains a short description of the project planning and diagnostics software for TURCK I/O-systems, the software I/O-ASSISTANT.

1.2 Overview

Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual includes all information necessary for the prescribed use of BL20 gateway BL20-E-GW-CO products. It has been specially conceived for personnel with the necessary qualifications.

1.2.1 Prescribed Use

Danger

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

1.2.2 Notes Concerning Planning /Installation of this Product

Danger

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

1.3 Description of Symbols Used

Danger

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating steps. These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

1.4 List of revisions

In comparison to the previous manual edition, the following changes/ revisions have been made:

Table 1-1: List of revisions

Chapter	Subject/Description	new	changed	deleted
5/6	BL20 - Communication in CANopen/ Diagnostics - Emergency Frames → seperate manual D301230			X
8	BL20-Approvals for Zone 2/ Division 2 → seperate manual D301255			X

Note

The publication of this manual renders all previous editions invalid.

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2.1 The Basic Concept

BL20 is a modular I/O system for use in industrial automation. It connects the sensors and actuators in the field with the higher-level master.

BL20 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (counters, RS232 interface...)

A complete BL20 station counts as one station on the bus and therefore occupies one fieldbus address in any given fieldbus structure. A BL20 station consists of a gateway, power distribution modules and I/O modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the BL20 station and the other fieldbus stations.

The communication within the BL20 station between the gateway and the individual BL20 modules is regulated via an internal module bus.

Note

The gateway is the only fieldbus-dependent module on a BL20 station. All other BL20 modules are not dependent on the fieldbus used.

Flexibility

All BL20 stations can be planned to accommodate the exact number of channels to suit your needs, because the modules are available with different numbers of channels in block and slice design.

A BL20 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industry.

Compactness

The slim design of the BL20 modules (standard gateway 50.4 mm / 1.98 inch, ECO gateway 34 mm/ 1.34 inch, standard slice 12.6 mm / 0.49 inch, ECO slice 13 mm / 0.51 inch and block 100.8 mm / 3.97 inch) and their low overall height favor the installation of this system in confined spaces.

Easy to handle

All BL20 modules of the standard line, with the exception of the gateway, consist of a base module and an electronics module.

The gateway and the base modules are snapped onto a mounting rail. The electronics modules are plugged onto the appropriate base modules.

The base modules of the standard line are designed as terminal blocks. The wiring is secured by tension clamp or screw connection.

The electronics modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

The ECO electronics modules combine base module and electronics module in one housing. All BL20-ECO modules can be used with the standard products with tension clamp connection technology.

2.2 BL20 Components

2.2.1 Gateways

The gateway connects the fieldbus to the I/O modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT.

ECO-Gateways

The BL20-ECO gateways enlarge the product portfolio of BL20. They offer an excellent cost/ performance ratio.

Further advantages of the BL20-ECO gateways:

- Available for PROFIBUS-DP and CANopen
- Low required space: width 34 mm/ 1.34 inch
- Integrated power supply
- Can be combined with all existing standard modules (with tension clamp connection technology) and ECO modules
- Simple wiring with „Push-in“ tension clamp terminals
- Setting of fieldbus address and bus terminating resistor via DIP-switches
- Service interface for commissioning with I/O-ASSISTANT (without PLC)

Figure 2-1:
Gateway
BL20-E-GW-CO

Gateways with Integrated Power Supply

All standard gateways BL20-GWBR-×××× as well as the BL20-gateways for DPV1 and Ethernet (BL20-GW-DPV1, BL20-GW-EN, BL20-GW-EN-IP, BL20-PG-EN and BL20-PG-EN-IP) offer an integrated power supply unit for feeding the gateway and the connected I/O modules.

It is not necessary to supply each individual module with a separate voltage.

Figure 2-2: Gateway example: BL20-GWBR-PBDP

Gateways without Power Supply

Note

The gateways without integrated power supply unit need an additional power supply module (bus refreshing module) which feeds the gateway an the connected I/O modules.

2.2.2 Power Distribution Modules

The power supply for gateways and I/O modules is fed to the power distribution modules; therefore, it is not necessary to supply each individual module with a separate voltage.

Figure 2-3: Power distribution module

2.2.3 Electronics Modules (Standard Product Line)

The standard electronics modules contain the I/O-functions of the BL20 modules (power distribution modules, digital and analog input/output modules, and technology modules).

They are plugged onto the base modules and are not directly connected to the wiring and can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 2-4: Electronics module in slice design

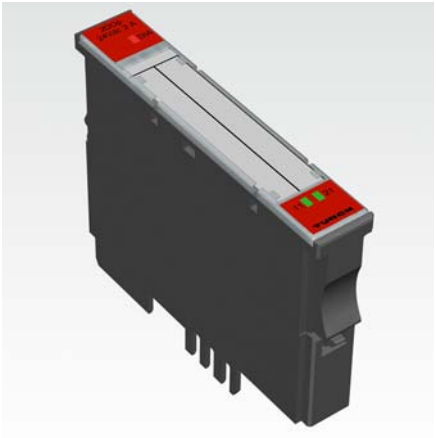
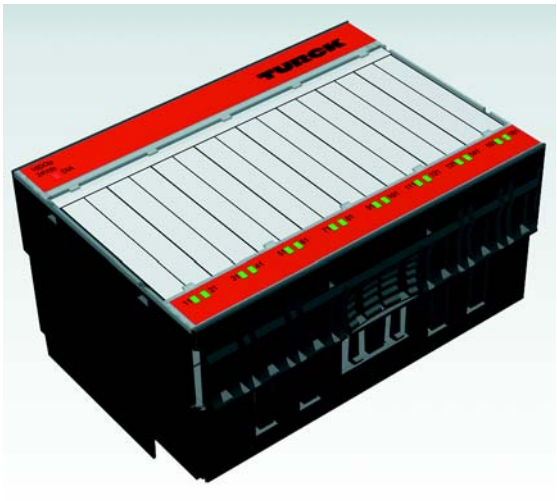


Figure 2-5: Electronics module in block design



2.2.4 ECO Electronics Modules

New ECONOMY modules with a high signal density and exceptionally low channel price expand the BL20 I/O bus terminal system.

Depending on type, up to 16 digital inputs and outputs can be connected on only 13 mm. This high connection density considerably reduces the mounting width required for typical applications.

All advantages at a glance:

- Space saving thanks to 16 channels on 13 mm/ 0.51 inch width
- Cost saving thanks to electronics with integrated connection level
- High signal density
- Tool-less connection via "push-in" spring-type terminal technology for simple and fast mounting
- Simple assembly reduces error sources

Figure 2-6: ECO I/O module

2.2.5 Base Modules

The field wiring is connected to the base modules. These are constructed as terminals in block and slice designs and are available in the following variations with either tension clamp or screw connections: 2-/3-wire (2-channel), 4-wire (2-channel) and 4 x 2-/3-wire (4-channel).

Figure 2-7: Base module with tension clamp connection

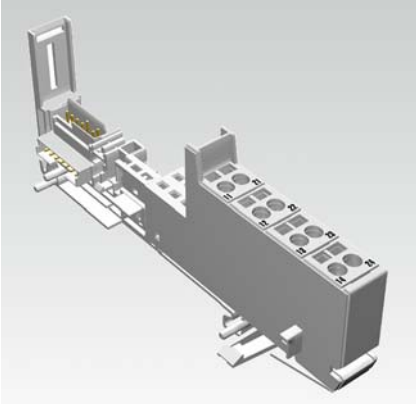


Figure 2-8: Base module with screw connection

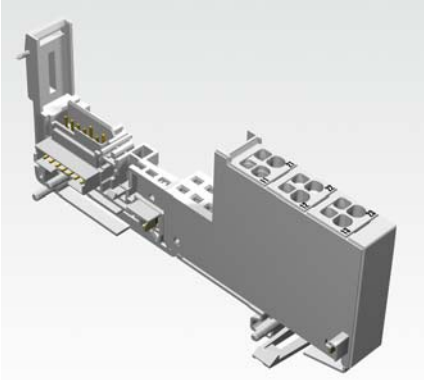
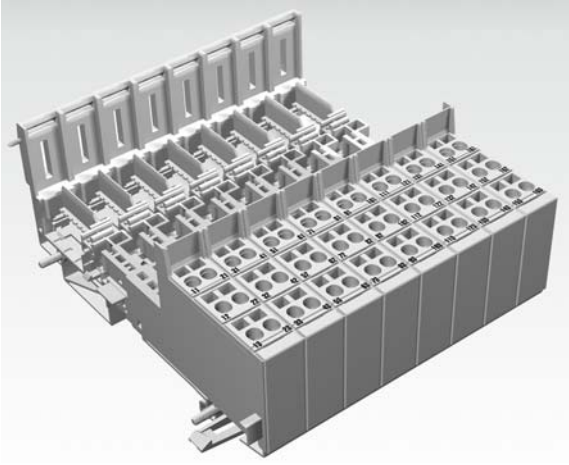


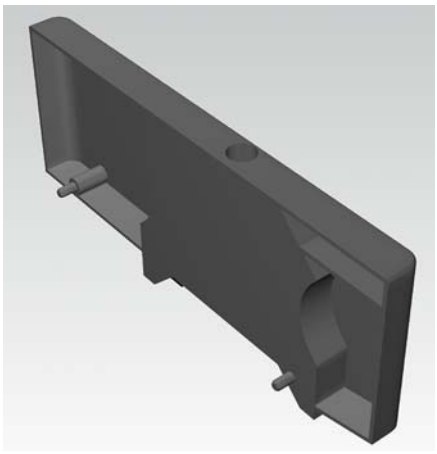
Figure 2-9: Base module in block design



2.2.6 End Plate

An end plate on the right-hand side physically completes the BL20 station. An end bracket mounted into the end plate ensures that the BL20 station remains secure on the mounting rail even when subjected to vibration.

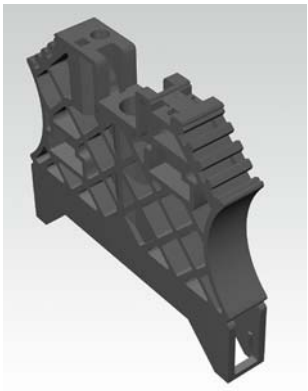
Figure 2-10: End plate



2.2.7 End Bracket

A second end bracket to the left of the gateway is necessary, as well as the one mounted into the end plate to secure the station.

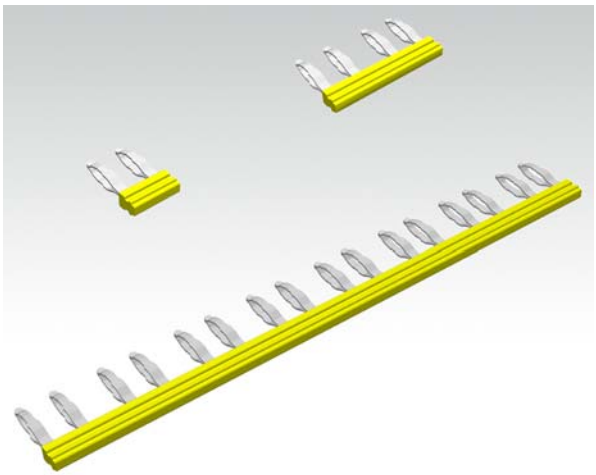
Figure 2-11: End bracket



2.2.8 Jumpers

Jumpers (QVRs) are used to bridge a connection level of a 4-wire base module. They can be used to connect potentials in relay modules (bridging the relay roots); thus considerably reducing the amount of wiring.

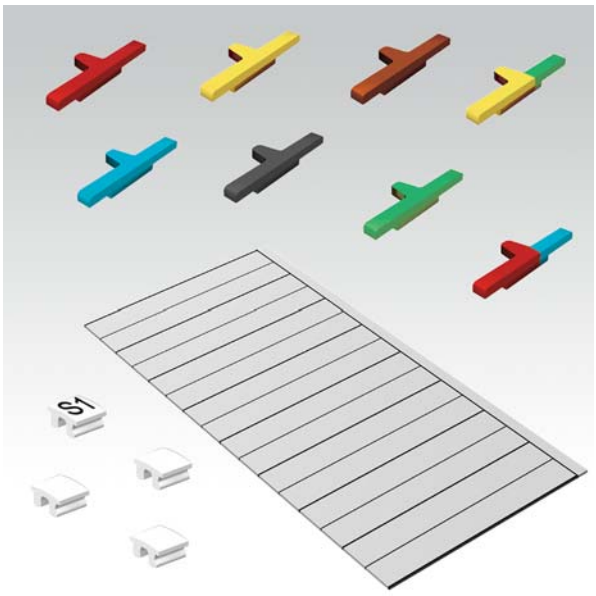
Figure 2-12: Jumpers



2.2.9 Marking Material

- Labels: for labeling BL20 electronics modules.
- Markers: for colored identification of connection levels of BL20 base modules.
- Dekafix connector markers: for numbering the mounting slots on BL20 base modules.

Figure 2-13: Marking material



2.2.10 Shield Connection (Standard Product Line)

If the gateway is wired directly to the fieldbus, it is possible to shield the connection using an attachment (BL20-SCH-1) on the gateway.

Figure 2-14: Shield connection (gateway)

2.2.11 Shield Connection (ECO Product Line)

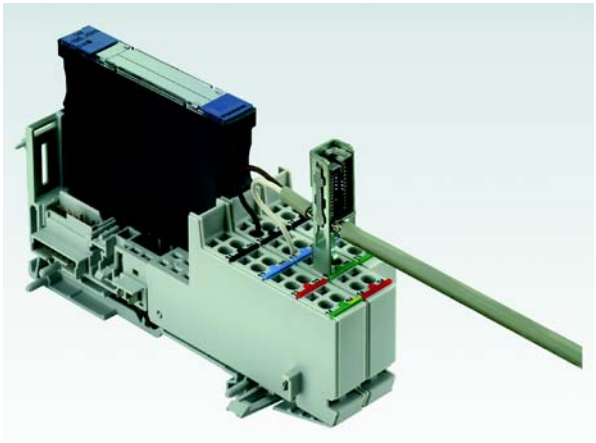
The shielding of the fieldbus connection at the BL20-E-GW-×× can be realized using shielding brackets on the mounting rail.

Figure 2-15: Shielding the bus cable via shielding brackets on the mounting rail

2.2.12 Shield Connection, 2-Pole for Analog Modules

The 2-pole shield connection can be used to connect signal-cable shielding to the base modules of analog input and output modules. A special tension-clamp operating tool (BL20-ZBW5-2) is required to mount the shield connection onto the base module.

Figure 2-16: Shield connection



3 Short description of CANopen

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3.1 CANopen

Note

The following description of CANopen is an excerpt from the homepage of CiA (CAN in Automation), the international users' and manufacturers' organization for CAN.

3.1.1 General

CANopen is an open, non-proprietary network protocol. It consists of a profile family, based on a communication profile and several device profiles. The CANopen communication profile is standardized as CiA DS-301 (Application Layer and Communication Profile).

The CANopen device profile for I/O-modules has been published as CiA DS-401 (Device Profile for I/O-Modules).

CANopen is based on the following standards:

- ISO 11 898 (Physical and Data Link Layer)
- Layers 1 and 2 of the ISO/OSI communication model
- CiA DS-301 (Application Layer and Communication Profile)
  C ANopen communication profile
- CiA DS-302 (Framework for Programmable CANopen Devices) CANopen Network Management NMT
- CiA DS-401 (Device Profile for I/O-modules)
- CiA DS-406 (Device Profile for Encoders)
  CANopen device profile for counter modules
- CiA DS-102 (CAN Physical Layer for Industrial Applications) General application in the field sector (connectors and bit rates) on the basis of ISO 11898

3.1.2 Communication

The lower layers of CANopen are defined according to the ISO-OSI model in the ISO 11898 standard.

Communication between the individual nodes is made by transmitting "Telegrams".

4 different types of telegram message are defined for CANopen:

- Network management messages
- Service data objects SDO
- Process data objects PDO
- Predefined messages

Network Management Messages

Network management messages are used in the network to control the nodes and their operating states. This type of message makes it possible, for instance, to configure the data transmission mechanism of a node.

The Network Management objects include Boot-up message, Heartbeat protocol and NMT message.

Boot-up message, Heartbeat and Node Guarding are implemented as single CAN frames with 1-byte data field.

The NMT message is mapped to a single CAN frame with a data length of 2 byte. Its identifier is 0. The first byte contains the command specifier and the second contains the Node-ID of the device that must perform the command (in the case of Node-ID 0 all nodes have to perform the command). The NMT message transmitted by the NMT master forces the nodes to transit to another NMT state. The CANopen state machine specifies the states Initialization, Pre-Operational, Operational and Stopped. After power-on, each CANopen device is in the state Initialization and automatically transits to the state Pre-operational. In this state, transmission of SDOs is allowed. If the NMT master has set one or more nodes into the state Operational, they are allowed to transmit and to receive PDOs. In the state Stopped no communication is allowed except that of NMT objects.

The state Initialization is divided into three sub-states in order to enable a complete or partial reset of a node. In the sub-state Reset Application the parameters of the manufacturer-specific profile area and the standardized device profile area are set to their power-on values. In the sub-state Reset Communication the parameters of the communication profile area are set to their power-on values. The third sub-state is initializing, which a node enters automatically after power-on. Power-on values are the last stored parameters.

The **Heartbeat protocol** is for error control purposes and signals the presence of a node and its state. The Heartbeat message is a periodic message of the node to one or several other nodes. It indicates that the sending node is still working properly.

A device sends the **Boot-up message** to indicate to the NMT master that it has reached the state Pre-operational. This occurs whenever the device initially boots-up but also after a power-out during operation. The Boot-up message has the same identifier as the Heartbeat object, however, its data content is zero.

Service Data Objects (SDOs)

A Service Data Object (SDO) reads from entries or writes to entries of the Object Dictionary.

The SDO transport protocol allows transmitting objects of any size. The first byte of the first segment contains the necessary flow control information including a toggle bit to overcome the problem of doubly received CAN frames. The next three bytes of the first segment contain index and sub-index of the Object Dictionary entry to be read or written. The last four bytes of the first segment are available for user data. The second and the following segments (using the very same CAN identifier) contain the control byte and up to seven bytes of user data. The receiver confirms each segment or a block of segments, so that a peer-to-peer communication (client/server) takes place.

Process Data Objects (PDOs)

Process Data Objects (PDOs) are mapped to a single CAN frame using up to 8 bytes of the data field to transmit application objects. Each PDO has a unique identifier and is transmitted by only one node, but it can be received by more than one (producer/consumer communication).

PDO transmissions

PDO transmissions may be driven by an internal event, by an internal timer, by remote requests and by the Sync message received:

- Event- or timer-driven:
  An event (specified in the device profile) triggers message transmission. An elapsed timer additionally triggers the periodically transmitting nodes.
- Remotely requested:
  Another device may initiate the transmission of an asynchronous PDO by sending a remote transmission request (remote frame).
- Synchronous transmission:
  In order to initiate simultaneous sampling of input values of all nodes, a periodically transmitted Sync message is required. Synchronous transmission of PDOs takes place in cyclic and acyclic transmission mode. Cyclic transmission means that the node waits for the Sync message, after which it sends its measured values. Acyclically transmitted synchronous PDOs are triggered by a defined application-specific event.

Special Function Objects

CANopen also defines three specific protocols for synchronization, emergency indication, and time-stamp transmission.

- **Synchronization object (Sync)**
  The Sync Object is broadcast periodically by the Sync Producer. The time period between Sync messages is defined by the Communication Cycle Period, which may be reset by a configuration tool to the application devices during the boot-up process. There can be a time jitter in transmission by the Sync Producer due to some other objects with higher prior identifiers or by one frame being transmitted just before the Sync message. The Sync message is mapped to a single CAN frame with the identifier 128 by default. The Sync message does not carry any data.
- **Emergency object (Emcy)**
  The Emergency message is triggered by the occurrence of a device internal error situation and are transmitted from an Emergency producer on the concerned application device. This makes them suitable for interrupt type error alerts. An Emergency message is transmitted only once per 'error event'. As long as no new errors occurs on a device, no further Emergency message can be transmitted. Zero or more Emergency consumers may receive these. The reaction of the Emergency consumer is application-specific. CANopen defines several Emergency Error Codes to be transmitted in the Emergency message, which is a single CAN frame with 8 data byte.
- **Time stamp object (Time)**
  By means of Time-Stamp, a common time frame reference is provided to application devices. It contains a value of the type Time-of-Day. This object transmission follows the producer/consumer push model. The associated CAN frame has the pre-defined identifier 256 and a data field of 6-byte length.

3.2 BL20 and CANopen

BL20 supports the following CANopen functions:

- SDO transfer, any length of information
- Emergency object
- Sync frame evaluation
- Event-driven PDOs
- Synchronous PDOs (clock-synchronous)
- Remote-requested PDO/polling

3.3 Electronic data sheet – EDS file

CANopen nodes are embedded in the CANopen structure by the help of a standardized EDS file (Electronic Data Sheet).

The EDS file lists all necessary Objects with their corresponding Sub-indices and the matching entries.

The latest version of a particular EDS file can be downloaded directly from the TURCK Homepage www.turck.com.

4 Eco-Gateway for CANopen

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4.1 Introduction

This chapter contains a description of BL20-ECO-gateways for the standardized fieldbus CANopen. The chapter is divided up as follows: a description of functions, general and specific technical data, a description of addressing and status displays.Funktion

4.1.1 Function

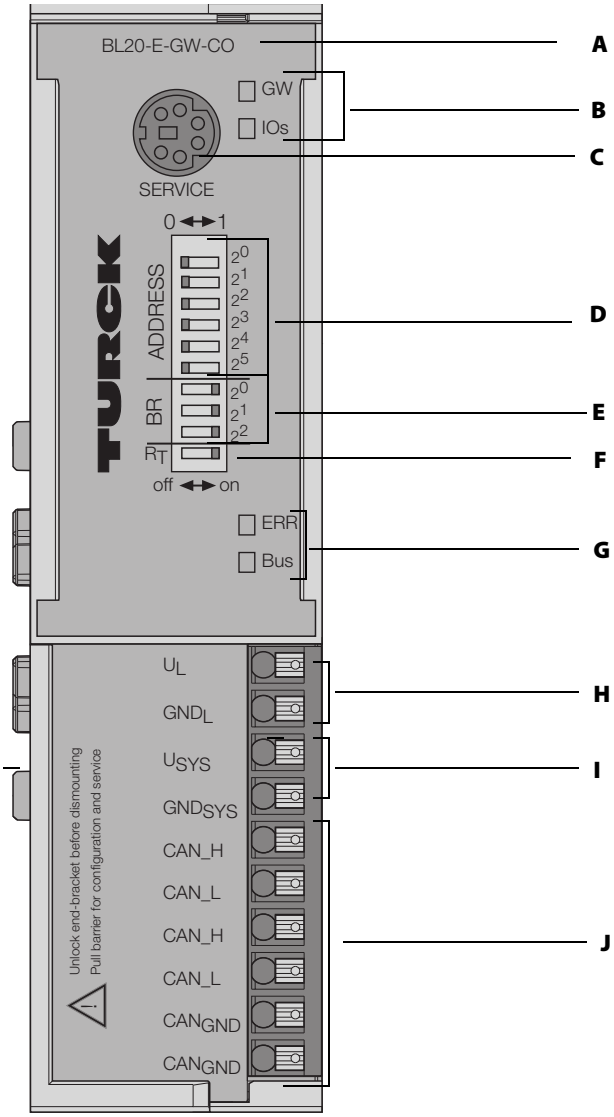
The BL20 gateways enable BL20 modules to operate on CANopen. The gateway is the connection between the BL20 modules and a CANopen host system. It regulates the process data between the I/O level and the fieldbus and generates diagnostic data for the higher-level host system.

Information is made available to the software tool I/O-ASSISTANT via the service interface.

4.2 Technical Data

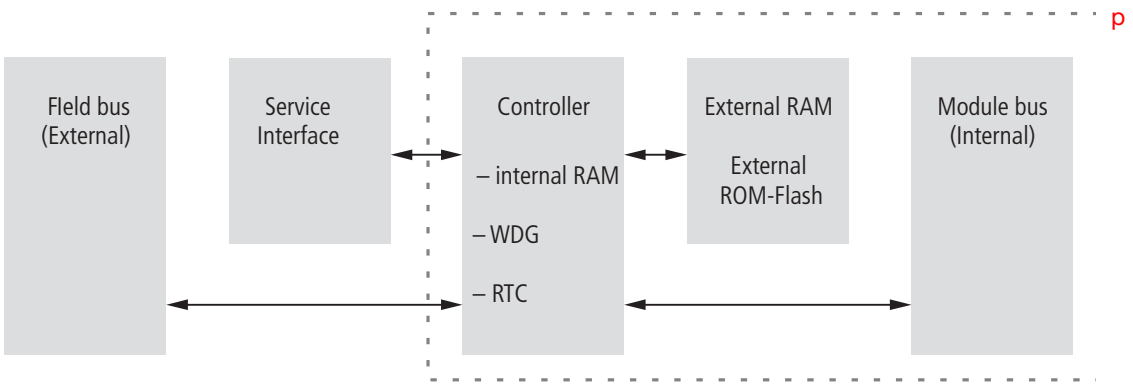
Figure 4-1: Gateway BL20-E-GW-CO

A *Type designation*
B *LEDs for BL20 module bus*
C *service interface*
D *DIP switch for the Node-ID*
E *DIP switch for the bit rate*
F *DIP switch for the terminating resistor*
G *LEDs for CANopen*
H *field supply*
I *system supply*
J *CANopen*



Structure of a BL20-ECO gateway

Figure 4-2: Structure of a BL20-ECO gateway



4.2.1 General Technical Data of a Station

Attention

The auxiliary power supply must comply with the stipulations of SELV (Safety Extra Low Voltage) according to IEC 364-4-41.

Table 4-1: General technical data of a station

Supply voltage/ auxiliary voltage	
U_{sys} Nominal value (provision for other modules)	24 V DC
I_{sys} (at maximum station extension) → see chapter 6, page 6-3 ff.	ca. 500 mA
Permissible range	according to EN 61131-2 (18 to 30 V DC)
Residual ripple	according to EN 61131-2
Isolation voltage (U_L to U_{SYS})	500 V_{eff}
Voltage anomalies	according to EN 61131-2
I_{MB} (supply of module bus nodes)	700 mA
Connection technology	Push-in tension clamp terminals LSF from Weidmueller
Physical interfaces	
Fieldbus	
Protocol	CANopen
Transmission rate	20 kBit/s to 1 Mbit/s
Isolation voltage (field to U_{sys} and to U_L)	500 V_{eff}
Fieldbus connection	Push-in tension clamp terminals LSF from Weidmueller
Address setting	via DIP-switch (addresses 1 to 63)
Service interface	
connection	RS232 via PS2/ mini DIN female connector
Ambient conditions	
Ambient temperature	
– $t_{Ambient}$	0 to +55 °C / 32 to 131 °F
– t_{Store}	-25 to +85 °C / 13 to 185 °F
Relative humidity according to EN 61131-2/EN 50178	5 to 95 % (indoor), Level RH-2, no condensation (storage at 45 °C, no function test)

Climatic tests	according to IEC 61131-2
Resistance to vibration according to IEC 61131-2	
10 to 57 Hz, constant amplitude 0.075 mm / 0.003 inch, 1 g	Yes
57 to 150 Hz, constant acceleration 1 g	Yes
Mode of vibration	Frequency sweeps with a change in speed of 1 Octave/min
Period of oscillation	20 frequency sweeps per axis of coordinate
Shock resistant according to IEC 68-2-27	18 shocks, sinusoidal half-wave 15 g peak value/11 ms, in each case in ± direction per space coordinate
Resistance to repetitive shock according to IEC 68-2-29	1 000 shocks, half-sinus 25 g peak value/6 ms, in each case in ± direction per space coordinate
Topple and fall according to IEC 68-2-31 and free fall according to IEC 68-2-32	
Height of fall (weight < 10 kg)	1,0 m
Height of fall (weight 10 to 40 kg)	0,5 m
Test runs	7
Device with packaging, electrically tested printed-circuit board.	
Electromagnetic compatibility (EMC) according to EN 50 082-2 (Industry)	
Static electricity according to EN 61 000-4-2	
– Discharge through air (direct)	8 kV
– Relay discharge (indirect)	4 kV
Electromagnetic HF fields according to EN 61 000-4-3 and ENV 50 204	10 V/m
Conducted interferences induced by HF fields according to EN 61 000-4-6	10 V
Fast transients (Burst) according to EN 61 000-4-4	
Emitted interference according to EN 50 081-2 (Industry)	according to EN 55 011 Class A, Group 1

A *This device can cause radio disturbances in residential areas. Additional measures to suppress the disturbance are necessary.*

Approvals and Tests

Table 4-2: Approvals and tests

Description	
Approvals	
UL cUL	in preparation
Tests (EN 61131-2)	
Cold	DIN IEC 68-2-1, temperature -25 °C / -13 °F, duration 96 h; not in use
Dry heat	DIN IEC 68-2-2, Temperature +85 °C / 185 °F, duration 96 h; device not in use
Damp heat, cyclic	DIN IEC 68-2-30, temperature +55 °C / 131 °F, duration 2 cycles every 12 h; device in use
Operational life MTBF	120 000 h
Pollution severity according to IEC 664 (EN 61 131-2)	2
Protection class according to IEC 529	IP20

4.2.2 Technical Data for the Push-in tension clamp terminals

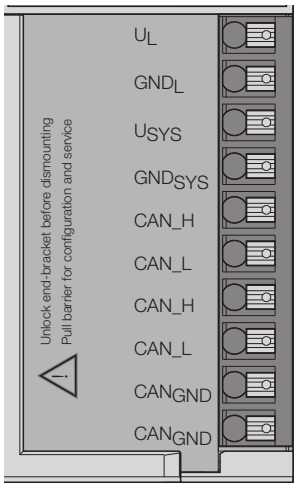
Table 4-3: Technical data for the Push-in tension clamp terminals

Designation	
Protection class	IP20
Insulation stripping length	8 mm + 1/ 0.32 inch + 0,039
Max. wire range	0.14 to 1.5 mm^2 / 0.0002 to 0.0023 $inch^2$ / 26 to 16 AWG
Crimpable wire	
"e" solid core H 07V-U	0.14 to 1.5 mm^2 / 0.0002 to 0.0023 $inch^2$/ 26 to 16 AWG
"f" flexible core H 07V-K	0.5 to 1.5 mm^2 / 0.0008 to 0.0023 $inch^2$ / 25 to 16 AWG
"f" with ferrules according to DIN 46 228/1 (ferrules crimped gas-tight)	0.25 to 1.5 mm^2 / 0.0004 to 0.0023 $inch^2$ / 30 to 16 AWG

4.3 Connection Possibilities at the Gateways

The fieldbus connection as well as the power supply connection are realized via Push-in tension clamp terminals.

Figure 4-3: Push-in tension clamp terminals at the gateway



Attention

Mixing-up the connectors for power supply and bus connection can lead to the destruction of the gateways electronics!

4.3.1 Voltage Supply

The BL20-E-GW-CO provides an integrated power supply and has connectors for:

- field supply (U_L, GND_L)

and

- system supply (U_{SYS}, GND_{SYS})

4.3.2 Fieldbus Connection via Push-in Tension Clamp Terminals

Push-in tension clamp terminals are also used for the gateway's communication via CANopen.

The pin assignment for the tension clamp terminals is as follows:

Table 4-4: Pin assignment for the Push-in tension clamp terminals for the bus connection

Designation	Description	
CAN_H	CAN Bus H	CAN-bus connection with T-function
CAN_L	CAN Bus L	
CAN_H	CAN Bus H	
CAN_L	CAN Bus L	
CAN_{GND}	CAN Bus Ground	
CAN_{GND}	CAN Bus Ground	

Note

The shielding of the field bus cable is established directly on the mounting rail using a SHLD terminal.

Note

Equipotential bonding impedance ≤ 1/10 shielding impedance.

4.4 Service Interface Connection

In order to connect the service interface on the gateway with a PC and the I/O-ASSISTANT software (project planning and diagnostics software), a cable with a pin assignment, different from the PS2 standard pin assignment, has to be used:

- I/O-ASSISTANT-KABEL-BL20/BL67

Attention

Standard commercial cables will have to be rewired!

4.4.1 Connection through an I/O-ASSISTANT Cable

The I/O-ASSISTANT cable is fitted with a PS/2 plug (connection to the socket on the gateway) and a SUB-D socket (connection to the plug on the PC).

Note

The service interface can be found under the upper label of the gateway. Pull the label upwards out of the housing in order to reach the service interface.

Figure 4-4: PS/2 plug on the connection cable to the gateway (top view)

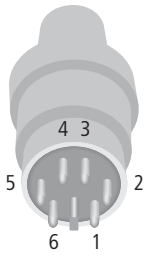


Figure 4-5: 9-pole SUB-D socket connector on the cable for connecting to PC (top view)

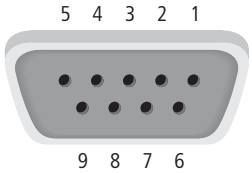


Table 4-5: Pin assignment PS/2- and SUB-D-interface

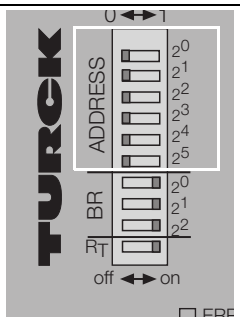
Pin	BL20 gateway PS/2-socket	Sub-D-interface at the PC	Pin
1	CLK	DTR, DSR	4, 6
2	GND	GND	5
3	DATA	–	–
4	n.c. (DATA2)	RxD	2
5	+5V	RTS	7
6	n.c. (CLK2)	TxD	3

4.5 Setting the Node-ID

The setting of the Node-ID for the BL20-ECO gateway for CANopen is done via the DIP switches at the gateway.

These DIP switches can be found under the gateway's upper label.

Figure 4-6: DIP-switches on the gateway



Note

Pull the label upwards out of the housing in order to reach the DIP-switches.

Attention

The Node-ID of an ECO gateway is limited to values of 1 to 63.
Other nodes at the CANopen bus can use Node-IDs up to 127. Each Node-ID can only be assigned once in the entire CANopen bus structure.

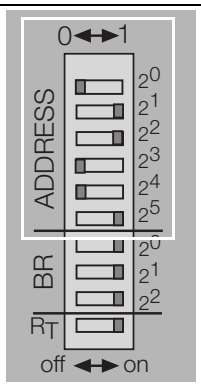
The gateway's bus address results from the addition of the valences (2^0 to 2^5) of the switched DIP-switches (position = 1).

Default setting:

0×3FH = ADR 63

Example:
Bus address 38 = 0×26 = 100110

Figure 4-7: Bus address 38

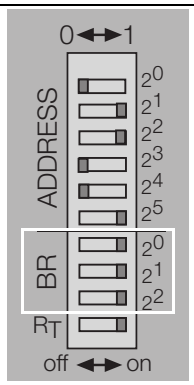


The internal module bus does not require any addressing.

4.6 Setting the Bit Rate

The gateway BL20-E-GW-CO offers 3 DIP switches for setting the bit rate (**BR**).

Figure 4-8: DIP switches for setting the bit rate



DIP switch no.	Bit rate							
	reserved	**20 kBit/s**	**50 kBit/s**	**125 kBit/s**	**250 kBit/s**	**500 kBit/s**	**800 kBit/s**	**1 MBit/s**
2^0	1	0	1	0	1	0	1	0
2^1	1	1	0	0	1	1	0	0
2^2	1	1	1	1	0	0	0	0

4.7 Activating the Bus Terminating Resistor

If the gateway is used as the first or the last station in the bus communication, the fieldbus line has to be terminated using a terminating resistor.

The BL20-E-GW-CO allows the activation of the resistors $\mathbf{R_T}$ using the last DIP-switch.

Figure 4-9: Bus terminating resistor R_T

Bus terminating resistor switched off:

Bus terminating resistor switched on:

4.8 Acceptance of the BL20 Station Configuration

When making a new configuration of the BL20 station or an alteration of the existing station structure (“module list”), the current configuration must be accepted in the CANopen mirror of the BL20 gateway.

The configuration acceptance at this device is done via the DIP switches set to address 0.

Please proceed as follows:

1. Set the DIP switches at the gateway to a Node-ID ≠ “0“.
2. Switch on the system supply U_{sys} and the field supply U_L.
3. Set the Node-ID to “0“.
   → The device stores the station’s configuration. This is indicated by the flashing of the “IOs“ LED.
   → After the storage procedure, the “IOs“ LED shortly flashes orange and than stops flashing.
   → The LEDs “Err“ and “Bus“ flash alternately red with 4 Hz due to the invalid Node-ID “0“ which is still set at the gateway.
4. De-energize the gateway and set a Node-ID ≠ “0“ at the gateway.
   → After power-on, the “IOs“ LED changes to green after approximately 2 seconds.

Note

The green "IOs" LED indicates that the current BL20 configuration matches the stored reference module list.

Attention

If the new configuration stored to the gateway does not match the old configuration, all CANopen-parameters are set to their default values. Therefore it is necessary, to reload the whole station parameterization.

4.9 Status Indicators/ Diagnostic Messages Gateway

The gateway transmits the following diagnostics: the status of the BL20 station, the communication via the internal module bus, the communication to CANopen and the status of the gateway.

Diagnostic messages are displayed in two ways:

- via individual LEDs
- via the software of the respective host system (i. e. PLC)

4.9.1 Diagnostic Messages via LEDs

Every BL20 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): GW and IOs
- 2 LEDs for CANopen communication (fieldbus LEDs): ERR and Bus

Table 4-6: LED displays

LED	Status	Meaning	Remedy
GW	OFF	CPU not supplied.	Check the wiring at the gateway or at the Bus refreshing module.
	Green	5 V DC operating voltage is present; firmware is active; gateway is ready for operation and transfer	-
	green, blinking, 1 Hz	undervoltage at U_{sys} or U_L	Check that the supply voltage is within the permissible range.
	GW: green, flashing, 1 Hz IOs: red	Firmware not active	Reload the firmware!
	Green, flashing, 4 Hz	Firmware active, gateway hardware is defect	Replace the gateway.
IOs	OFF	CPU not supplied.	Check the voltage supply.
	Green	Module bus is running, the configured module bus station corresponds to the physically connected station, communication is active.	-
	Green, flashing 1 Hz	Station is in the I/O-ASSISTANT Force Mode.	Deactivate the I/O-ASSISTANT Force Mode.
	Red and LED "**GW**" off	Controller is not ready, U_{sys} level is not within the required range.	Check the wiring for U_{sys} at the gateway.

Table 4-6: LED displays

LED	Status	Meaning	Remedy
IOs	Red	Module bus not ready-to-operate	– Check the correct mounting of the single BL20-modules
	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned BL20 station with the physical station. – Check the physical station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	no module bus communication	– Check the station configuration and the voltage supply at the gateway and at the supply modules.
	Red/green flashing, 1 Hz	Adaptable modification of the physically connected station; data transfer possible	– Check the physical station for pulled or new but not planned modules.
ERR	Off	No errors in communication between the BL20-CANopen gateway and other CANopen nodes	–
	Red	Faulty or interrupted communication between BL20-CANopen gateway and other CANopen. Possible causes: – CAN-BusOff – Heartbeat error – Guarding error – Transmit timeout	– Check that the fieldbus ends with a termination resistor, if the BL20-CANopen gateway is the last node in the bus topology. – Check the seating of the CANopen bus connector (or the joints in the case of direct wiring). All connections must be correct and properly seated. – Check the CANopen cable for possible damage, and for correct connections. – Check that the correct bit rate has been set. – Check that the NMT-master is still functioning properly.
BUS	green	NMT-slave state of the BL20-CANopen gateway is "Operational"	-
	red	NMT-slave state of the BL20-CANopen gateway is "Stopped"	– „Reset-Node“-command from NMT-master for the respective node necessary. – If this command is not successful, execute a voltage reset.
	orange	NMT-slave state of the BL20-CANopen gateway is "Pre-Operational"	„Start-Node“-command from NMT-master necessary.
ERR + BUS	red, flashing alternately, 4 Hz	Invalid Node-ID has been set	Set the correct Node-ID with the DIP switches (1 to63). .

5 BL20 - Communication in CANopen

Note

The CANopen-description for BL20 can be found in a separate manual „BL×× CANopen-object register “ D301230 under www.turck.de.

6 Guidelines for Station Planning

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6.1 Module Arrangement

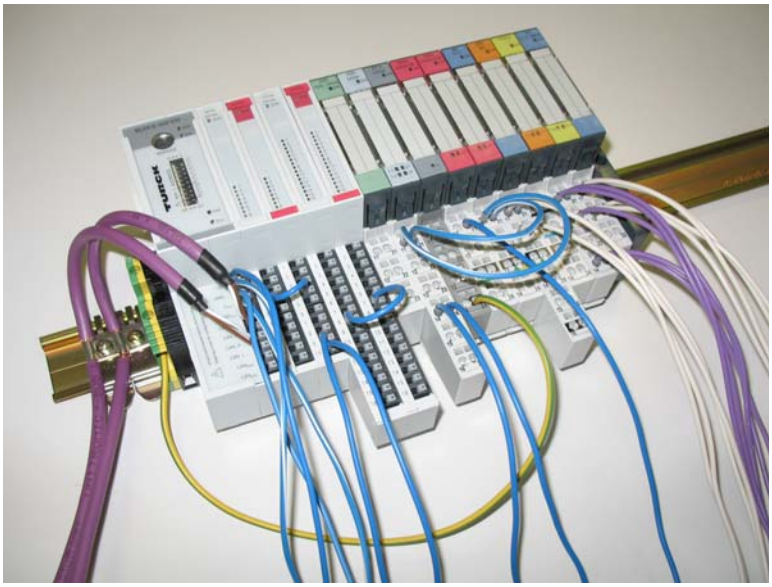
6.1.1 Random Module Arrangement

The arrangement of the I/O modules within a BL20 station can basically be chosen at will. Nevertheless, it can be useful with some applications to group certain modules together.

Note

A mixed usage of gateways of the BL20 ECO and the BL20 standard product line and I/O modules of both product lines (base modules with tension clamp terminals) is possible without any problems.

Figure 6-1: Example of a station structure with ECO gateway, ECO and standard I/O modules



Note

The mixed usage of base modules with screw connections and base modules with tension clamp connections requires a further power supply module to be mounted. Thereby, it must be ensured that the base modules are fitted with the same connection technology (screw or tension clamp) as the power supply module.

6.1.2 Complete Planning

The planning of a BL20 station should be thorough to avoid faults and increase operating reliability.

Attention

If there are more than two empty slots next to one another, the communication is interrupted to all following BL20 modules.

The power to BL20 systems is supplied from a common external source. This avoids the occurrence of potential compensating currents within the BL20 station.

6.2 Maximum System Extension

The maximum number of modules within BL20 station with the gateway BL20-E-GW-CO depends on the following factors:

- The maximum permissible number of **252** communication bytes which are transmitted via the module bus from the modules to the gateway must not be exceeded (see below Table 6-1: Communication bytes and nominal current consumptions of the BL20 modules).
- If the maximum sum of the modules' nominal current consumptions (see below Table 6-1: Communication bytes and nominal current consumptions of the BL20 modules) right to the gateway (max. sum ΣI_{MB} = **700 mA**) is reached, a Bus Refreshing module has to be used in order to provide the module bus voltage.
  Right to the Bus Refreshing module, the sum of the modules' current consumptions can amount to **1,5 A**.
- The station must not exceed the station limit of 62 modules.

Further limitations can occur using Power Feeding modules BL20-PF-24VDC-D/ BL20-PF-120/230VAC-D. They are used to build up potential groups or in case of insufficient power supply.

Attention

Ensure that a sufficient number of Bus Refreshing and Power Feeding modules are used if the system is extended to its maximum.

Note

If the system limits are exceeded, the software I/O-ASSISTANT generates an error message when the user activates the command "Station → Verify".

For the calculation of the maximum system extension, the following table contains an overview about communication bytes as well as about the modules' nominal current consumptions:

Table 6-1: Communication bytes and nominal current consumptions of the BL20 modules

Module	Number of communication bytes	Nominal current consumption at the module bus
BL20-BR-24VDC-D	2	-
BL20-PF-24VDC-D	2	28 mA
BL20-PF-120/230VAC-D	2	25 mA
BL20-2DI-24VDC-P	1	28 mA
BL20-2DI-24VDC-N	1	28 mA
BL20-2DI-120/230VAC	1	28 mA
BL20-4DI-24VDC-P	1	29 mA
BL20-4DI-24VDC-N	1	28 mA
BL20-4DI-NAMUR	5	40 mA
BL20-E-8DI-24VDC-P	1	15 mA

Table 6-1: Communication bytes and nominal current consumptions of the BL20 modules

Module	Number of communication bytes	Nominal current consumption at the module bus
BL20-E-16DI-24VDC-P	2	15 mA
BL20-16DI-24VDC-P	2	45 mA
BL20-32DI-24VDC-P	4	30 mA
BL20-1AI-I(0/4...20MA)	3	41 mA
BL20-2AI-I(0/4...20MA)	5	35 mA
BL20-1AI-U(-10/0...+10VDC)	3	41 mA
BL20-2AI-U(-10/0...+10VDC)	5	35 mA
BL20-2AI-PT/NI-2/3	5	45 mA
BL20-2AI-THERMO-PI	5	45 mA
BL20-4AI-U/I	9	30 mA
BL20-2DO-24VDC-0.5A-P	2	32 mA
BL20-2DO-24VDC-0.5A-N	2	32 mA
BL20-2DO-24VDC-2A-P	2	33 mA
BL20-2DO-120/230VAC-0.5A	2	35 mA
BL20-4DO-24VDC-0.5A-P	2	30 mA
BL20-E-8DO-24VDC-0.5A-P	2	15 mA
BL20-E-16DO-24VDC-0.5A-P	2	25 mA
BL20-16DO-24VDC-0.5A-P	3	120 mA
BL20-32DO-24VDC-0.5A-P	5	30 mA
BL20-1AO-I(0/4...20MA)	4	39 mA
BL20-2AO-I(0/4...20MA)	7	40 mA
BL20-2AO-U(-10/0...+10VDC)	7	43 mA
BL20-2DO-R-NC	1	28 mA
BL20-2DO-R-NO	1	28 mA
BL20-2DO-R-CO	1	28 mA
BL20-1CNT-24VDC	9	40 mA
BL20-1RS232	9	140 mA
BL20-1RS485/422	9	60 mA
BL20-1SSI	9	50 mA

Table 6-1: Communication bytes and nominal current consumptions of the BL20 modules

Module	Number of communication bytes	Nominal current consumption at the module bus
BL20-2RFID-×	9	30 mA
BL20-E-1SWIRE	9	60 mA

6.3 Power Supply

6.3.1 Power Supply to the Gateway

The gateways BL20-E-GW-CO offer an integrated power supply (see also Voltage Supply page 4-7)

6.3.2 Module Bus Refreshing

The number of BL20 modules, which can be supplied via the internal module bus by the gateway or a Bus Refreshing module depends on the modules' nominal current consumptions at the module bus (see page 6-3).

Attention

The sum of the nominal current consumptions of the modules following directly the gateway BL20-E-GW-CO must not exceed 700 mA. If a Bus Refreshing module is mounted, the sum of the current consumptions which follow the Bus Refreshing module must not exceed 1,5 A.

Note

The Bus Refreshing modules which are used in a station with BL20-E-GW-CO have to be combined with the base modules BL20-P3T-SBB-B or BL20-P4T-SBBC-B (tension clamp) or with the base modules BL20-P3S-SBB-B or BL20-P4S-SBBC-B (screw terminals).

With the system supply, it must be ensured that the same ground potential and ground connections are used. Compensating currents flow via the module bus if different ground potentials or ground connections are used, which can lead to the destruction of the Bus Refreshing module.

All Bus Refreshing modules are connected to one another via the same ground potential.

The power to the module bus is supplied via the connections 11 and 21 on the base module.

If the power supply from the module bus is not guaranteed, the software I/O-ASSISTANT 3 (FDT/DTM) generates an error message when the user activates the DTM "Additional functtions → Verify station".

6.3.3 Creating Potential Groups

Bus Refreshing and Power Feeding modules can be used to create potential groups. The potential isolation of potential groups to the left of the respective power distribution modules is provided by the base modules.

Attention

Ensure that the correct base modules are planned for when using Bus Refreshing modules.

Note

The system can be supplied with power independent of the potential group formation.

When using a digital input module for 120/230 V AC, it should be ensured that a potential group is created in conjunction with the Power Feeding module BL20-PF-120/230VAC-D.

Attention

It is not permitted to use the modules with 24 V DC and 120/230 V AC field supply in a joint potential group.

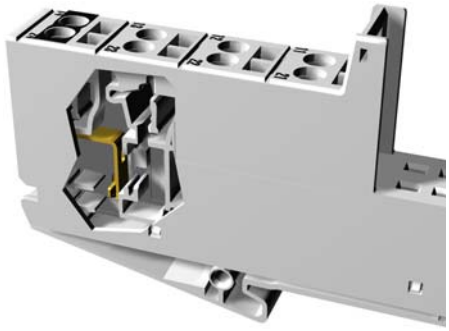
6.3.4 C-Rail (Cross Connection)

The C-rail runs through all base modules. The C-rail of the base modules for power distribution modules is mechanically separated; thus potentially isolating the adjoining supply groups.

Access to the C-rail is possible with the help of base modules with a C in their designation (for example, BL20-S4T-SBCS). The corresponding connection level is indicated on these modules by a thick black line. The black line is continuous on all I/O modules. On power distribution modules, the black line is only above the connection 24. This makes clear that the C-rail is separated from the adjoining potential group to its left.

Figure 6-2: C-rail front view

Figure 6-3: C-rail side view



Warning

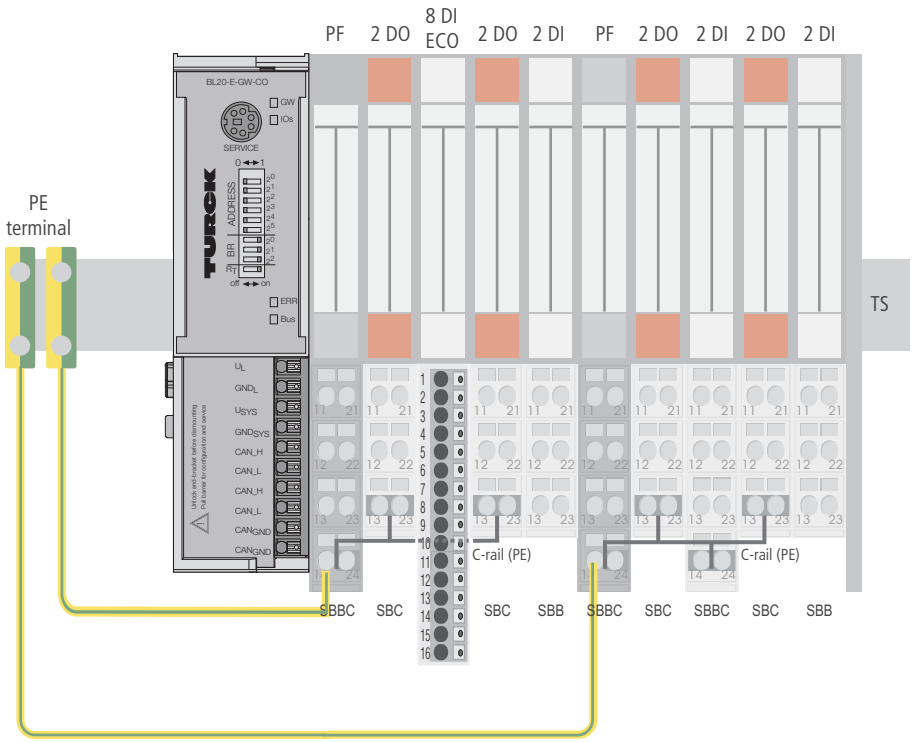
It is permitted to load the C-rail with a maximum of 24 V. Not 230 V!

The C-rail can be used as required by the application, for example, as a protective earth (PE). In this case, the PE connection of each power distribution module must be connected to the mounting rail via an additional PE terminal, which is available as an accessory.

Note

For information about introducing a BL20 station into a ground reference system, please read chapter 6.

Figure 6-4: Using the C-rail as a protective earth



C-rails can be used for a common voltage supply when relay modules are planned. To accomplish this, the load voltage is connected to a Power Feeding module with the BL20-P4x-SBBC base module with tension clamp or screw connection. All the following relay modules are then supplied with power via the C-rail.

Attention

When relay modules are planned and the C-rail is used for a common voltage supply, a further power distribution module must be used for the potential isolation to the following modules. The C-rail can only again be used as a PE following potential isolation.

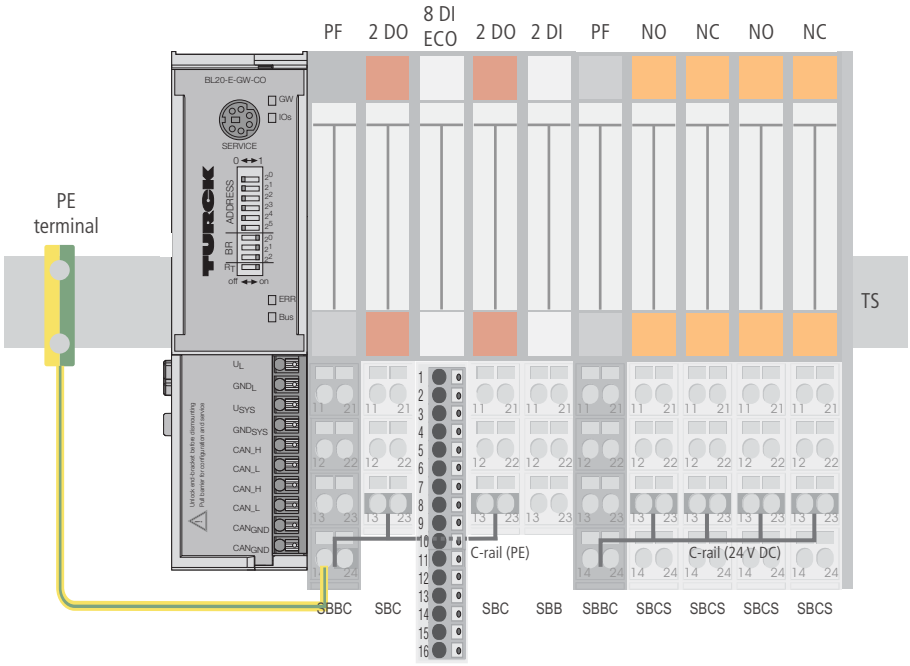


Figure 6-5: Using the C-rail as protective earth and for the power supply with relay modules

Cross-connecting relay module roots is achieved by the use of jumpers. The corresponding wiring diagram including the jumpers can be found the manuals for BL20 I/O modules (German D300716, English D300717).

6.3.5 Direct Wiring of Relay Modules

As well as the options mentioned above, relay modules can be wired directly. In this case, base modules without C-rail connections should be chosen to guarantee the potential isolation to the adjoining modules.

6.4 Protecting the Service Interface on the Gateway

During operation, the label protecting the service interface and the DIP-switches must remain closed due to EMC and ESD.

6.5 Plugging and Pulling Electronics Modules

BL20 enables the pulling and plugging of electronics modules without having to disconnect the field wiring. The BL20 station remains in operation if an electronics module is pulled. The voltage and current supplies as well as the protective earth connections are not interrupted.

Attention

If the field and system supplies remain connected when electronics modules are plugged or pulled, short interruptions to the module bus communications can occur in the BL20 station. This can lead to undefined statuses of individual inputs and outputs of different modules.

6.6 Extending an Existing Station

Attention

Please note that extensions to the station (mounting further modules) should be carried out only when the station is in a voltage-free state.

6.7 Firmware Download

Firmware can be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT. More information is available in the program's online help.

Attention

The station should be disconnected from the fieldbus when downloading.

Firmware must be downloaded by authorized personnel only.

The field level must be isolated.

7 Guidelines for Electrical Installation

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7.1 General Notes

7.1.1 General

Cables should be grouped together, for example: signal cables, data cables, heavy current cables, power supply cables.

Heavy current cables and signal or data cables should always be routed in separate cable ducts or bundles. Signal and data cables must always be routed as close as possible to ground potential surfaces (for example support bars, cabinet sides etc.).

7.1.2 Cable Routing

Correct cable routing prevents or suppresses the reciprocal influencing of parallel routed cables.

Cable Routing Inside and Outside of Cabinets

To ensure EMC-compatible cable routing, the cables should be grouped as follows

Group 1:

- shielded bus and data cables
- shielded analog cables
- unshielded cables for DC voltage ≤ 60 V
- unshielded cables for AC voltage ≤ 25 V

Group 2:

- unshielded cables for DC voltage > 60 V and ≤ 400 V
- unshielded cables for AC voltage > 25 V and ≤ 400 V

Group 3:

- unshielded cables for DC and AC voltages > 400 V

Various types of cables within the groups can be routed together in bundles or in cable ducts.

The following group combination can be routed only in separate bundles or separate cable ducts (no minimum distance apart):

- Group 1/Group 2

The group combinations:

- Group 1/Group 3 and Group 2/Group 3

must be routed in separate cable ducts with a minimum distance of 10 cm apart. This is equally valid for inside buildings as well as for inside and outside of switchgear cabinets.

Cable Routing Outside Buildings

Outside of buildings, cables should be routed in closed (where possible), cage-type cable ducts made of metal. The cable duct joints must be electrically connected and the cable ducts must be earthed.

Warning

Observe all valid guidelines concerning internal and external lightning protection and grounding specifications when routing cables outside of buildings.

7.1.3 Lightning Protection

The cables must be routed in double-grounded metal piping or in reinforced concrete cable ducts.

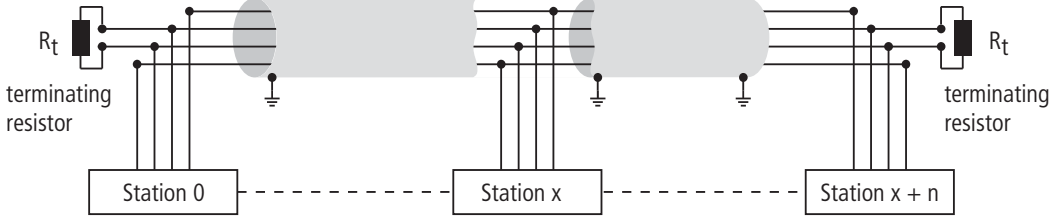
Signal cables must be protected against overvoltage by varistors or inert-gas filled overvoltage arrestors. Varistors and overvoltage arrestors must be installed at the point where the cables enter the building.

7.1.4 Transmission Cables

The slaves on the bus are connected to one another with fieldbus lines that correspond to the DeviceNet specification (ODVA Spec. Rel. V2.0).

The bus cables must be terminated at the beginning and end with a bus terminating resistor. This can be connected via the number DIP switch R_T on the gateway.

Figure 7-1: Representation of a bus cable



Cable Types

Turck offers a variety of cable types for fieldbus lines as premoulded or bulk cables.

The ordering information for the available cable types can be found in the TURCK BL20 catalogs.

7.2 Potential Relationships

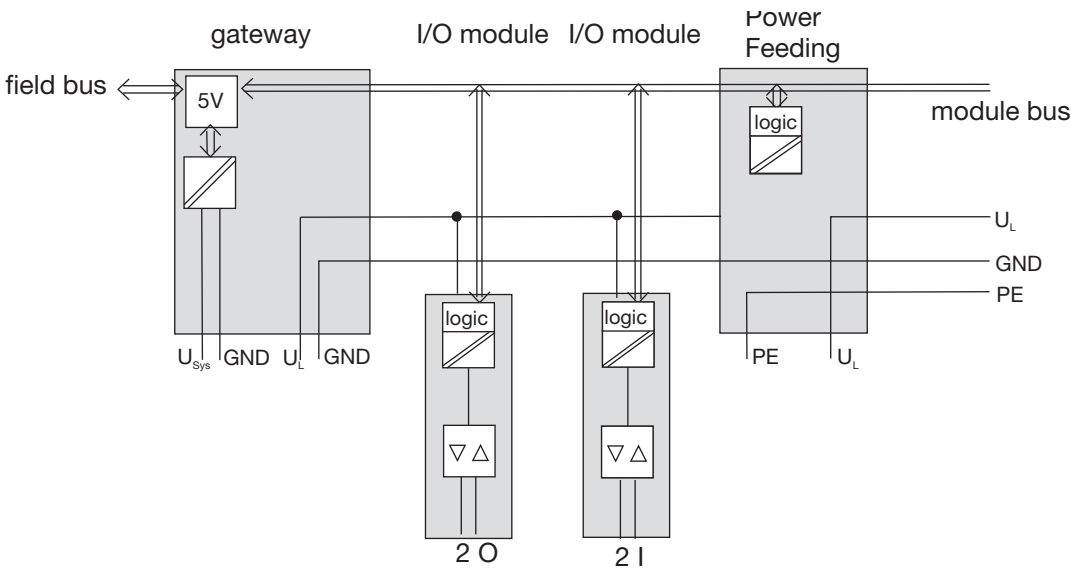
7.2.1 General

The potential relationship of a PROFIBUS-DP system realized with BL20 modules is characterized by the following:

- The system's power supply to the gateway, I/O modules and the field level is connected to the gateway.
- All BL20 modules (gateway, Power Feeding and I/O modules) are connected capacitively via base modules to the mounting rails.
- Separate power supplies for the system and the field level allow a potential-free installation.

The block diagram shows the arrangement of a typical BL20 with the ECO gateway BL20-E-GW-DP.

Figure 7-2: Block diagram of a BL20 station with an ECO-DP gateway



7.2.2 Potential-Free Installation

In a potential-free installation, the reference potentials of control and load circuitry are galvanically isolated from each other.

A potential-free installation is necessary with

- All AC load circuits (for example, when using the Power Feeding module BL20-PF-120/230VAC-D)
- Floating DC load circuits

The potential-free installation does not depend on the method of grounding.

7.3 Electromagnetic Compatibility (EMC)

BL20 products comply in full with the requirements pertaining to EMC regulations. Nevertheless, an EMC plan should be made before installation. Hereby, all potential electromechanical sources of interference should be considered such as galvanic, inductive and capacitive couplings as well as radiation couplings.

7.3.1 Ensuring Electromagnetic Compatibility

The EMC of BL20 modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

7.3.2 Grounding of Inactive Metal Components

All inactive metal components (for example: switchgear cabinets, switchgear cabinet doors, supporting bars, mounting plates, top-hat rails, etc.) must be connected to one another over a large surface area and with a low impedance (grounding). This guarantees a standardized reference potential area for all control elements and reduces the influence of coupled disturbances.

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.
- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Warning

The grounding must never – including cases of error – take on a dangerous touch potential. For this reason, always protect the ground potential with a protective cable.

7.3.3 PE Connection

A central connection must be established between ground and PE connection (protective earth).

7.3.4 Earth-Free Operation

Observe all relevant safety regulations when operating an earth-free system.

7.3.5 Protection against high frequency interference signals

Attention

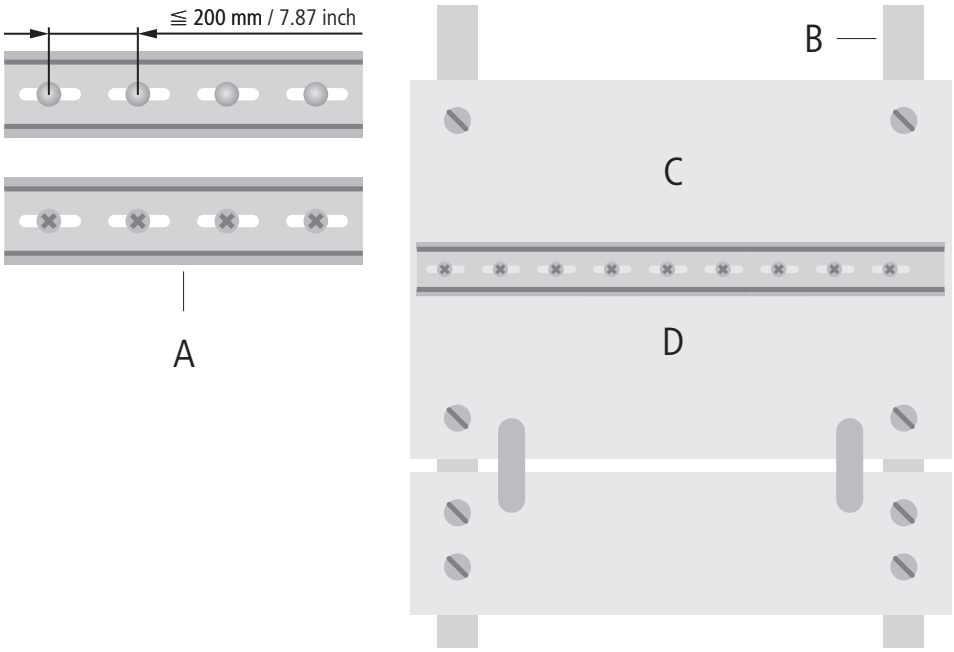
In order to comply with radiation limit values in accordance with EN 55 011/2 000, the supply lines for supplying the gateway with power are to be fed through a ferrite ring (PS416-ZBX-405). This is to be placed immediately next to the connection terminals. From there on, it is not permitted to make connections to further devices.

7.3.6 Mounting Rails

All mounting rails must be mounted onto the mounting plate with a low impedance, over a large surface area, and must be correctly earthed.

Figure 7-3: Mounting options

A *TS 35 mounting rail*
B *Mounting rail*
C *Mounting plate*
D *TS 35 mounting rail*

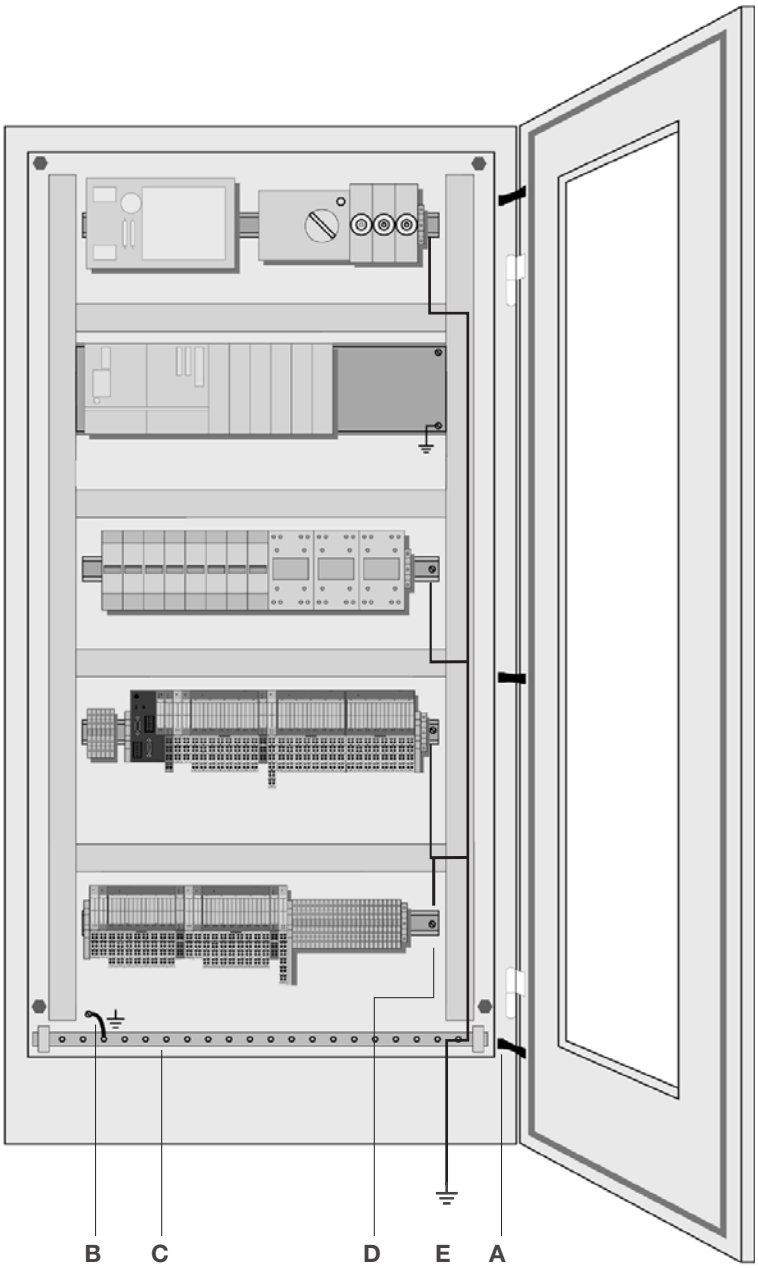


Mount the mounting rails over a large surface area and with a low impedance to the support system using screws or rivets.

Remove the isolating layer from all painted, anodized or isolated metal components at the connection point. Protect the connection point against corrosion (for example with grease; caution: use only suitable grease).

7.3.7 EMC Compliant Cabinet Installation

Figure 7-4: EMC compliant cabinet installation



A *Bonding straps*
Bonding straps connect inactive metal components, if it is not possible to create a large surface area contact. Use short bonding straps with large surface areas.

B *Mounting plates*
Mounting plates used to hold control components must have a large surface area contact with the cabinet housing.

C *Protective conductor rail*
The protective conductor rail must also be connected over a large surface area to the mounting plates and additionally with an external cable (cross-section at least 10 mm2 / 0,015 inch2) to the protective conductor system to avoid interference currents.

D *Protective conductor terminal block*
The protective conductor terminal block must be connected to the protective conductor rail.

E *Protective conductor system cable (grounding point)*
The cable must be connected over a large surface area with the protective conductor system.

7.4 Shielding of cables

Shielding is used to prevent interference from voltages and the radiation of interference fields by cables. Therefore, use only shielded cables with shielding braids made from good conducting materials (copper or aluminum) with a minimum degree of coverage of 80 %.

The cable shield should always be connected to both sides of the respective reference potential (if no exception is made, for example, such as high-resistant, symmetrical, analog signal cables). Only then can the cable shield attain the best results possible against electrical and magnetic fields.

A one-sided shield connection merely achieves an isolation against electrical fields.

Attention

When installing, please pay attention to the following...

- the shield should be connected immediately when entering the system,
- the shield connection to the shield rail should be of low impedance,
- the stripped cable-ends are to be kept as short as possible,
- the cable shield is not to be used as a bonding conductor.

If the data cable is connected via a SUB-D connector, the shielding should never be connected via pin 1, but to the mass collar of the plug-in connector.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is not in operation. The connection and securing of the shield should be made using metal shield clamps. The shield clamps must enclose the shielding braid and in so doing create a large surface contact area. The shield rail must have a low impedance (for example, fixing points of 10 to 20 cm apart) and be connected to a reference potential area. The cable shield should not be severed, but routed further within the system (for example, to the switchgear cabinet), right up to the interface connection.

Note

Should it not be possible to ground the shield on both sides due to switching arrangements or device specific reasons, then it is possible to route the second cable shield side to the local reference potential via a capacitor (short connection distances). If necessary, a varistor or resistor can be connected parallel to the capacitor, to prevent disruptive discharges when interference pulses occur.

A further possibility is a double-shielded cable (galvanically separated), whereby the innermost shield is connected on one side and the outermost shield is connected on both sides.

7.4.1 Potential Compensation

Potential differences can occur between installation components that are in separate areas and these

- are fed by different supplies,
- have double-sided conductor shields which are grounded on different installation components.

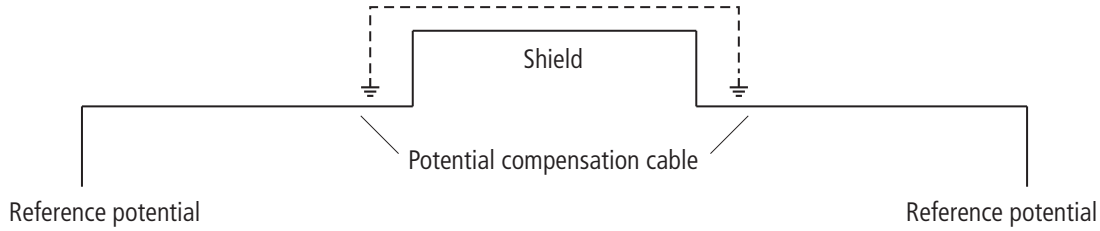
A potential-compensation cable must be routed to the potential compensation.

Warning

Never use the shield as a potential compensation.

Connection 1			Connection 2	
CAN_H	0	---------	0	CAN_H
CAN_L	0	---------	0	CAN_L
GND	0	---------	0	GND

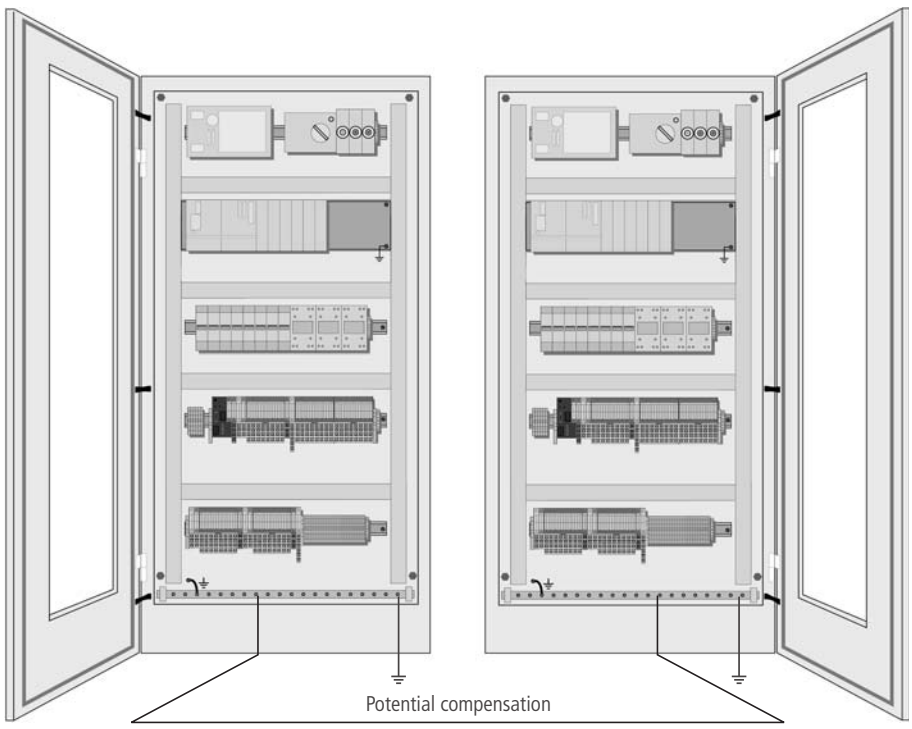
Figure 7-5: Potential compensation



A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.
- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

Figure 7-6: Potential compensation between switch-gear cabinets



7.4.2 Switching Inductive Loads

In the case of inductive loads, a protective circuit on the load is recommended.

7.4.3 Protection against Electrostatic Discharge (ESD)

Attention

Electronics modules and base modules are at risk from electrostatic discharge when disassembled. Avoid touching the bus connections with bare fingers as this can lead to ESD damage.

8 BL20-Approvals for Zone 2/ Division 2

Note

The Zone 2 - approval certificates for BL20 can be found in a separate manual for approvals D301255 on www.turck.de.

9 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

Identifier of, e.g. a memory position, a system or a module within a network.

Addressing

Allocation or setting of an address, e. g. for a module in a network.

Analog

Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Attribute

Attributes represent the data that a device makes available via the DeviceNet fieldbus (e. g. status of an object, serial number of the device, process data).

Automation device

A device connected to a technical process with inputs and outputs for control. Programmable logic controllers (PLC) are a special group of automation devices.

B

Baud

Baud is a measure for the transmission speed of data. 1 Baud corresponds to the transmission of one bit per second (Bit/s).

Baud rate

Unit of measurement for data transmission speeds in Bit/s.

Bidirectional

Working in both directions.

Bit Strobe

A Bit Strobe I/O connection is a connection between a DeviceNet client and an undetermined number of servers, these being queried by commands sent by the client.

Bonding strap

Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switchgear cabinet to the cabinet main body.

Bus

Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time

Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line

Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system

All units which communicate with one another via a bus.

C

Capacitive coupling

Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, e. g. parallel-routed signal cables, contactors and electrostatic discharges.

Class

A group of Objects that all describe the same system components. All Objects of a Class are identical in form and behavior, they can though contain different attributes.

COB

Communication Object, which is made of one or more CAN frames. Any information transmitted via CANopen has to be mapped into COBs (Source: CiA DS 401 V2.1).

COB-ID

COB-Identifier. Identifies a COB uniquely in a CAN network. The identifier determines the priority of that COB in the data link layer, too (Source: CiA DS 401 V2.1).

Coding elements

Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration

Systematic arrangement of the I/O modules of a station.

CPU

Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

Cyclic

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

D

Digital

A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN

German acronym for German Industrial Standard.

E

EDS

Electronic Device Data Sheet which contains standardized DeviceNet station descriptions. They simplify the planning of the DeviceNet nodes.

EIA

Electronic Industries Association – association of electrical companies in the United States.

Electrical components

All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC

Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

Voltage supply for devices in the field as well as the signal voltage.

Fieldbus

Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

Force Mode

Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

G

GND

Abbreviation of ground (potential "0").

Ground

Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection

One or more components that have a good and direct contact to earth.

Ground reference

Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

H

Hexadecimal

System of representing numbers in base 16 with the digits 0... 9, and further with the letters A, B, C, D, E and F.

Hysteresis

A sensor can get caught up at a certain point, and then "waver" at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I

/O

Input/output.

Impedance

Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components

Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

Inductive coupling

Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Instance

An Instance is defined as being an Object that is actually set up in a device.

J

Load value

Predefined value for the counter module with which the count process begins.

Lightning protection

All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant Bit

M

Mass

All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Module bus

The module bus is the internal bus in a BL20 station. The BL20 modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB

Most Significant Bit

N

NMT

see chapter 3 Short description of CANopen, Seite 3-1.

O

Overhead

System administration time required by the system for each transmission cycle.

P

PDO

see chapter 3 Short description of CANopen, Seite 3-3.

PLC

Programmable Logic Controller.

Polling

Establish a Polled I/O Connection, i. e. a conventional Master/Slave relationship between a controller and a DeviceNet device.

Potential compensation

The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free

Galvanic isolation of the reference potentials in I/O modules of the control and load circuits.

Potential linked

Electrical connection of the reference potentials in I/O modules of the control and load circuits.

Protective earth

Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

R

Radiation coupling

A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are e. g. sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g., radio), that are operated near to conducting structures.

Reaction time

The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

S

SDO

see chapter 3 Short description of CANopen, Seite 3-3.

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